Using DDS in UAV Control Stations

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Overview

- DDS provides the dynamic data bus needed for UAV control stations
- Discovery allows for the configuration to change for each vehicle
- Publish/subscribe works to decouple services allowing for different message sequences for each vehicle
- Partitions enable multiple vehicles by separating the software for each vehicle.
- Domains allow for separating flight critical software
- DDS Secure protects the domain from malignant services

**DDS meets the needs of the Control Station architecture**

Application

- The control stations provide command and control of an unmanned air vehicle (UAV)

- A common control station controls more than one type of UAV

- A control station is made up of a set of services

- Services defined by the Unmanned Systems (UxS) Control Segment (UCS) Architecture standard

- Some services are common to all vehicles

- Some services are unique to a single vehicle

The Control Station needs a dynamic, configurable messaging bus

Discovery

- The services for a vehicle consists of some of the common services and some of the unique

- Discovery allows the correct set of services for a specific vehicle type to be started

- DDS Discovery is dynamic so that any set of services can be started and they all discovery each other

- Vehicle service sets are configurable instead of hard coded
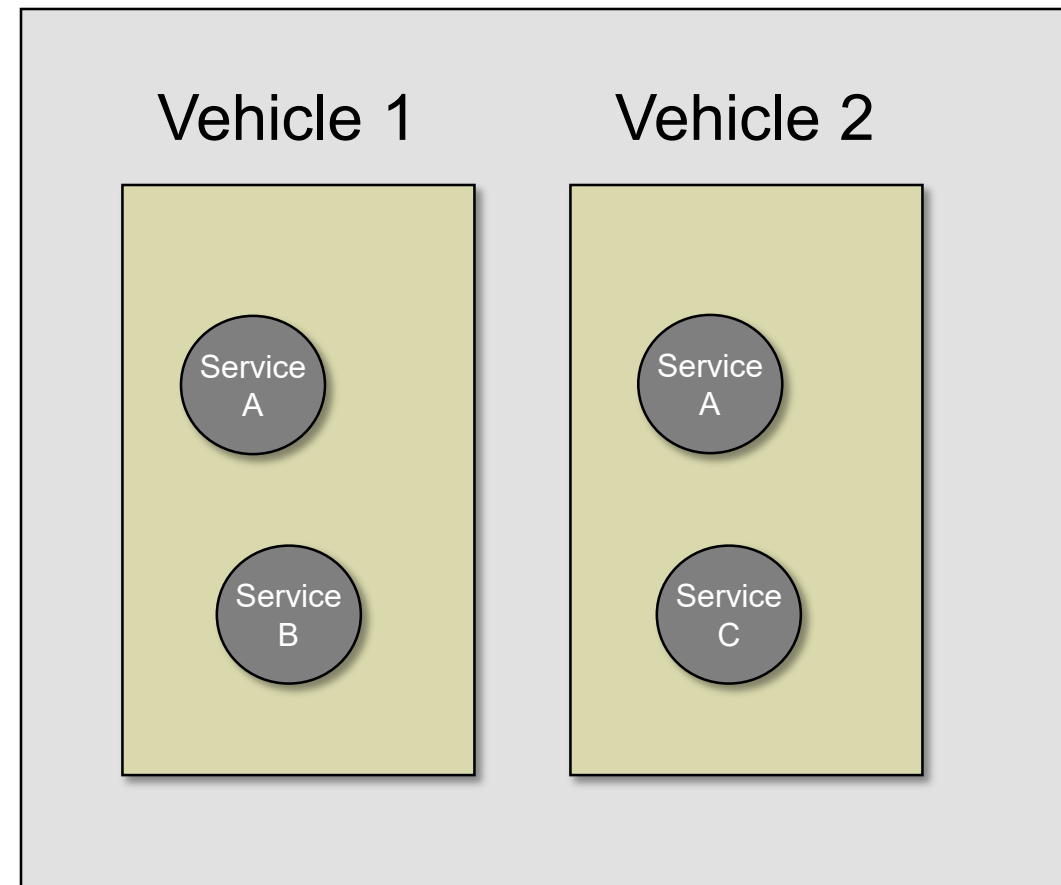
Publish/Subscribe

- With Pub/Sub, when a service publishes data, it does not need to know who is subscribing to the data
- The subscriber does not need to know who publishes it
- This decouples the publisher and the subscriber
- This allows different vehicles to have different communication paths without the services being modified
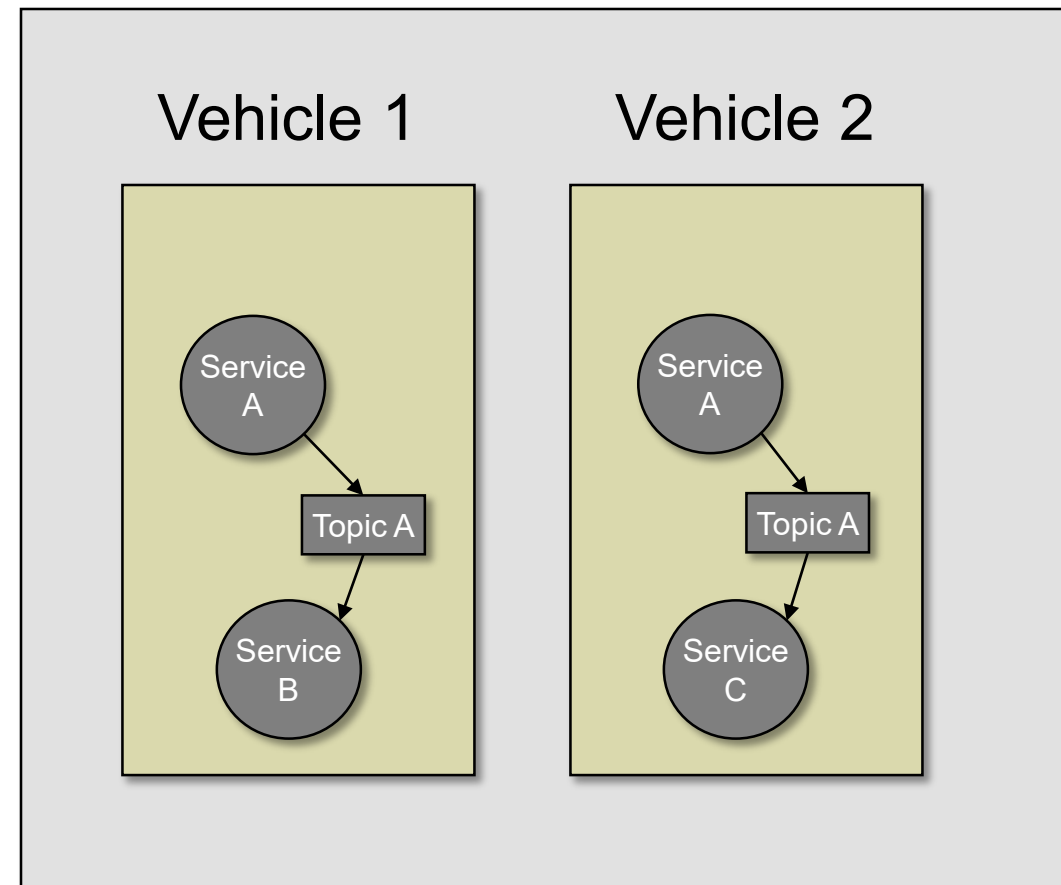
Partitions

- The control station can control multiple vehicles at once

- Within a domain, a partition is used to separate the services and topics for each vehicle

- The same set of topics and services may be used for each vehicle

- Partitions segregate the services to prevent cross communication
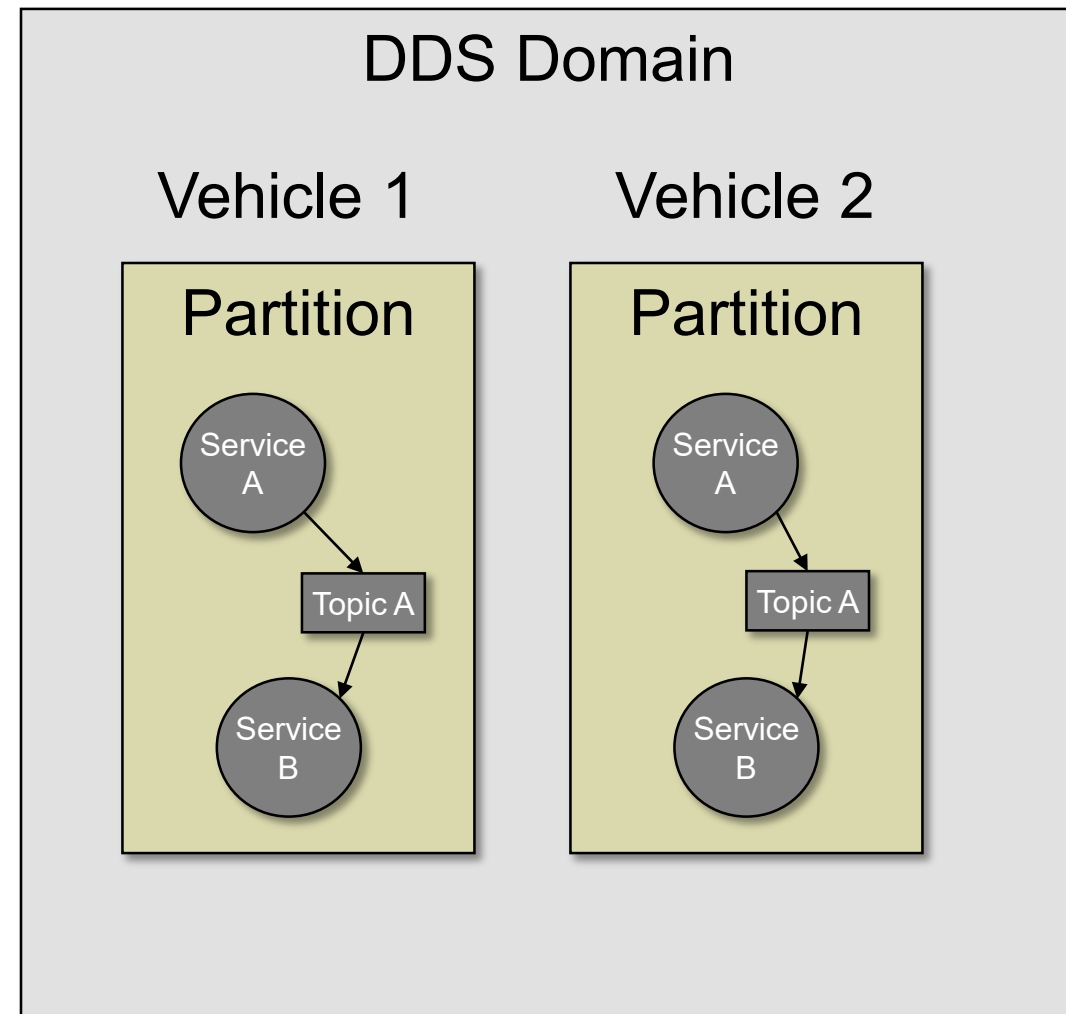
Flight Separation

- Safety requirements necessitate the separation of flight critical software from non-flight critical software
- Flight critical data is walled off in a separate domain
- Since discovery only works within an individual domain, Non Flight Critical services cannot see the Flight Critical Services
- The domains are connected using a bridge that is connected to both domains
- The bridge limits the data passed between the domains
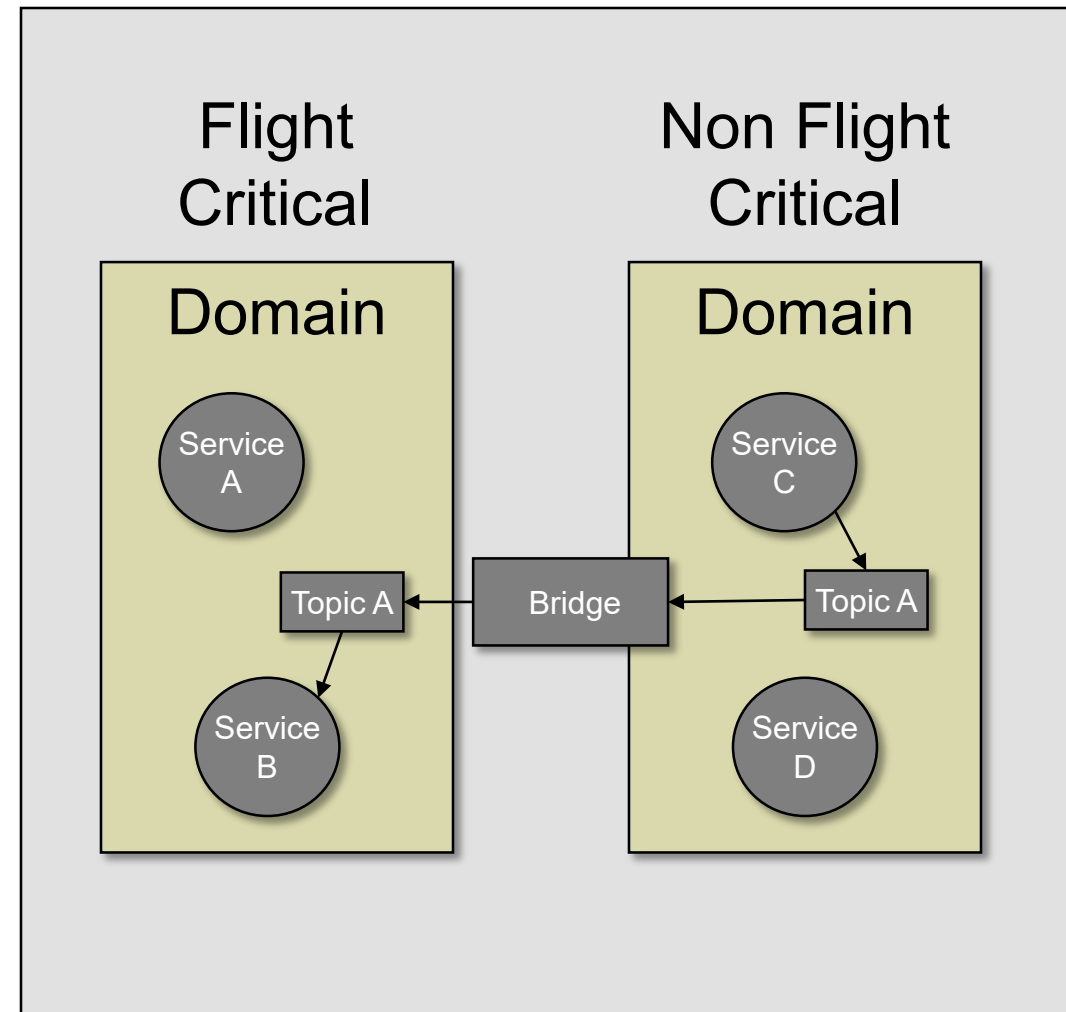
DDS Secure

- Separating flight critical data into a separate domain only solves part of the issue

- If the system is compromised, bad actors can still connect to the domain and disrupt the flight critical software

- DDS Secure ensure the only services in the flight critical domain are the correct services
  - Services must authenticate to join the domain and it's partitions
  - Services must further be authorized connect to topics

- DDS Secure encrypts the data to ensure its not modified in transit

DDS Secure protects the flight critical domain

Conclusion

- Control Systems require:
    - The highest levels of performance, scalability, reliability and security
    - A modular open systems architecture to minimize integration and foster reuse
    - Rapid reconfiguration to meet evolving mission requirements

- For these reasons, DDS is the connectivity standard for mission-critical systems.

Questions?